

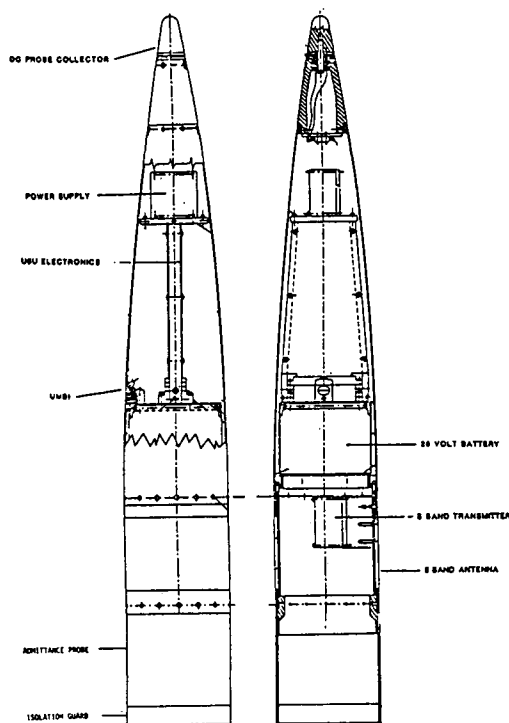
9.7 ROCKET MEASUREMENTS OF ELECTRON DENSITY IRREGULARITIES DURING MAC/SINE

J. C. Ulwick¹

Stewart Radiance Laboratory, Utah State University
Logan, UT 84321

Four Super Arcas rockets were launched at the Andoya Rocket Range, Norway, as part of the MAC/SINE campaign to measure electron density irregularities with high spatial resolution in the cold summer polar mesosphere. They were launched as part of two salvos: the turbulent/gravity wave salvo (3 rockets) and the EISCAT/SOUSY radar salvo (one rocket). In both salvos meteorological rockets, measuring temperature and winds, were also launched and the SOUSY radar, located near the launch site, measured mesospheric turbulence. Electron density irregularities and strong gradients were measured by the rocket probes in the region of most intense backscatter observed by the radar. The electron density profiles (8 - 4 on ascent and 4 on descent) show very different characteristics in the peak scattering region and show marked spatial and temporal variability. These data are intercompared and discussed.

¹Permanent address: 139 Great Road, Bedford, MA 01730



MAC/SINE SUPER ARCAS

Figure 1.

INSTRUMENTATION

DC PROBE: ON ALL FOUR SUPER ARCAS ROCKETS

TECHNIQUE - COLLECTION OF DC ELECTRON CURRENT OF ISOLATED TIP HELD AT FIXED +3-VOLT BIAS POTENTIAL WITH RESPECT TO ROCKET SKIN.

MEASUREMENT - HIGH RESOLUTION (SPATIAL TO ABOUT 10 CM) OF ELECTRON CURRENTS PRESUMED APPROXIMATELY PROPORTIONAL TO ELECTRON DENSITY.

RF PROBE: ON TWO OF FOUR SUPER ARCAS ROCKETS

TECHNIQUE - THE ROCKET BODY IS SPLIT (ISOLATED) AND FED AS A DIPOLE ANTENNA WHOSE RF ADMITTANCE AT 3 MHz IS TELEMETRED TO THE GROUND.

MEASUREMENT - LOW RESOLUTION ELECTRON DENSITY PROFILES.

MAC SINE SUPER ARCAS ROCKETS SUMMARY

ROCKET NO.	SALVOE	LAUNCH DATE/TIME	APOGEE	REMARKS
NASA 15.244 S-SA 1/L	TURBULENT GRAVITY WAVES	DAY 195 14 JULY 87 1000 L.T. (0800 UT)	95.4 KM	GOOD DC PROBE ASCENT & DESCENT
NASA 15.245 S-SA 2/H	TURBULENT GRAVITY WAVES	DAY 195 14 JULY 87 1129 L.T.	96.1 KM	GOOD DC PROBE ASCENT & DESCENT GOOD RF PROBE ASCENT & DESCENT
NASA 15.247 S-SA 3/H	TURBULENT GRAVITY WAVES	DAY 195 14 JULY 87 1455 L.T.	92.5 KM	GOOD DC PROBE ASCENT & DESCENT GOOD RF PROBE ASCENT & DESCENT
NASA 15.246 S-SA 4/L	EISCAT/SOUSY	DAY 196 15 JULY 87 1432 L.T.	97.7 KM	GOOD DC PROBE ASCENT & DESCENT

MS'T radar

$$\sigma = \frac{2\pi ck_B(T_s + \alpha T_C)}{P_T A_e \alpha^2 F_i} \left(\frac{r}{\Delta r} \right)^2 \frac{S}{N} \quad \text{Balsley and Gage [1980]}$$

$$\sigma = 1.15 \times 10^{-17} S/N \text{ m}^{-1}. \quad \text{Poker HST}$$

$$\sigma = C S/N \text{ m}^{-1}. \quad \text{Soucy}$$

Rocket

$$\sigma(k) = -n \left(\frac{\pi}{8} \right) k^2 \frac{f_p^4}{4f^4} \left(\frac{S_n(k)}{N_e^2} \right) \quad \text{Royruik and Smith [1984]}$$

$$\text{Poker } S/N = \frac{3.91 \times 10^{-11} (-n) N_e^2 V_R}{2\pi} \left(\frac{\Delta N_e}{N_e} \right)^2 \quad \text{where:}$$

n = Slope PSD
 N_e = Elec. Density
 V_R = Rocket Velocity

$$\text{Soucy } S/N = C (-n) N_e^2 V_R \left(\frac{\Delta N_e}{N_e} \right)^2 \quad \left(\frac{\Delta N_e}{N_e} \right)^2 = \text{Power at } f_D$$

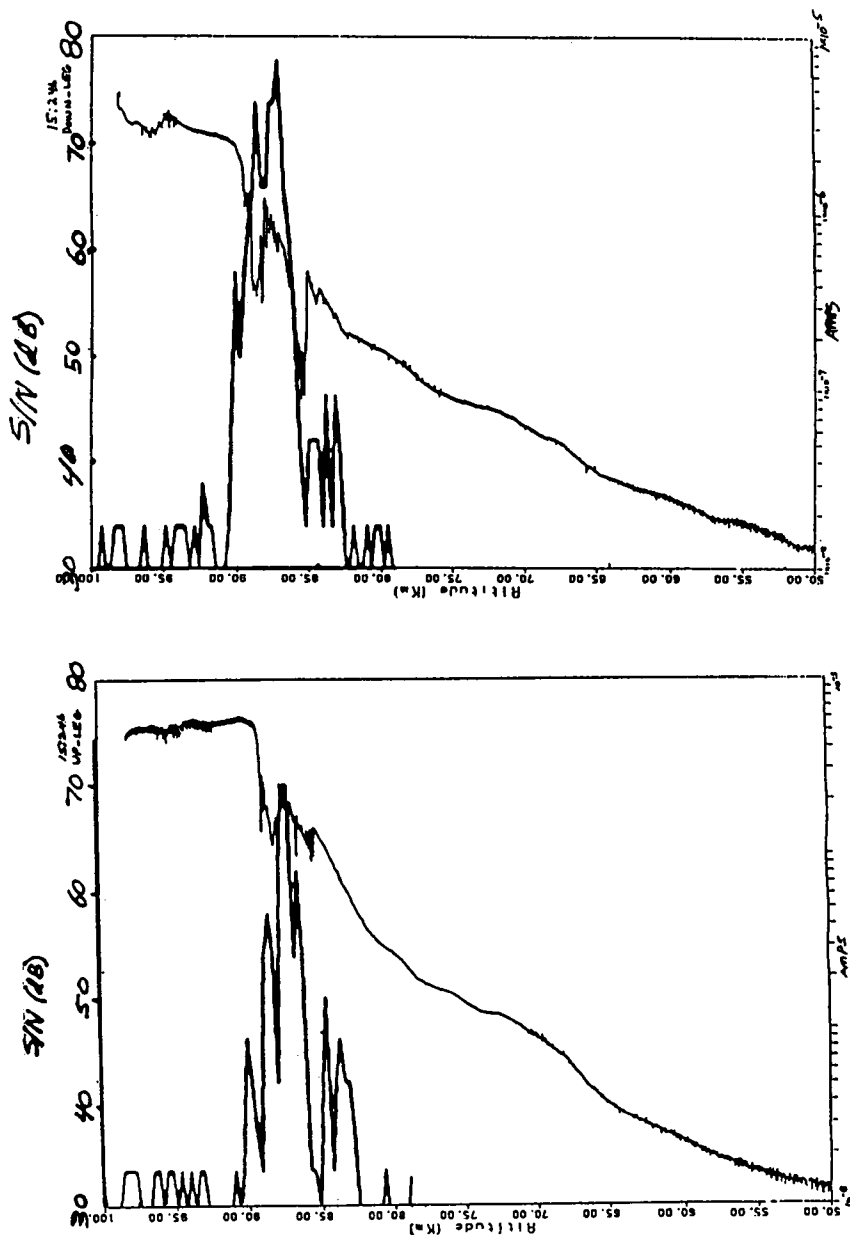


Figure 2.

ORIGINAL PAGE IS
OF POOR QUALITY

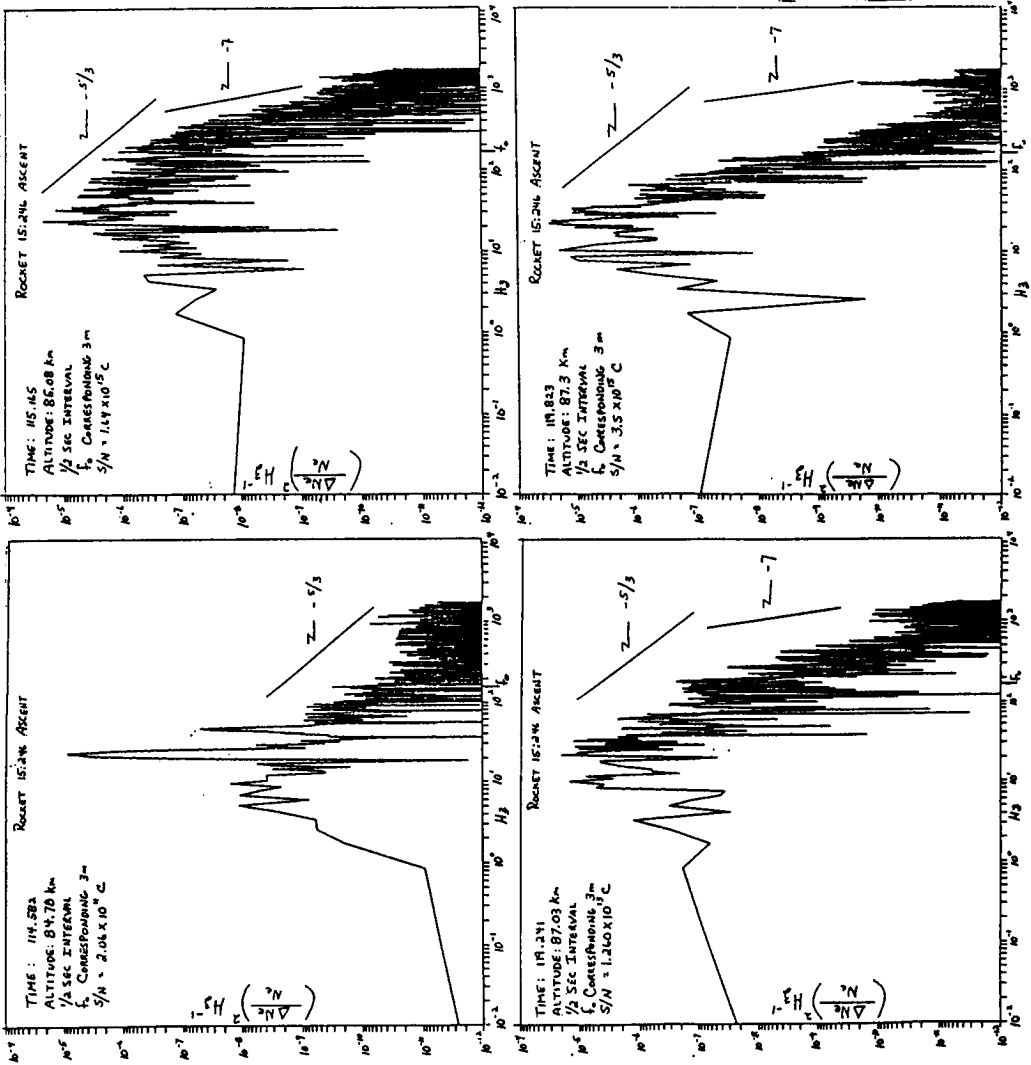


Figure 3.